

WHAT IS CLAIMED IS:

1. A method of detecting a scene change in a digital video sequence having a plurality of frames, the method comprising:

calculating a first root mean squared (RMS) value for a first frame relative to a second frame and the second frame relative to a third frame;

calculating a first mean absolute difference (MAD) value for the first frame relative to the second frame;

determining if the first RMS value meets a first criterion;

determining if the first MAD value meets a second criterion; and

designating the second frame as a scene change frame at least partly in response to determining that both the first RMS value meets the first criterion and the first MAD value meets the second criterion.

2. The method as defined in Claim 1, wherein the first RMS value is color weighted.

3. The method as defined in Claim 1, further comprising storing an I-frame designation in a file for the second frame and storing a P-frame designation for a third frame in the file.

4. The method as defined in Claim 1, wherein the first RMS value is based at least in part on pixel luminance values and chrominance values of the first and second frames.

5. The method as defined in Claim 1, wherein the first RMS value is defined as

$$RMS(F_i, F_k) = \frac{\alpha}{\alpha + \beta + \gamma} \sqrt{\frac{1}{w \times h} \sum_{x=1}^w \sum_{y=1}^h |Y_i(x, y) - Y_k(x, y)|^2} +$$
$$\frac{2\beta}{\alpha + \beta + \gamma} \sqrt{\frac{1}{w \times h} \sum_{x=1}^{w/2} \sum_{y=1}^{h/2} |U_i(x, y) - U_k(x, y)|^2} +$$
$$\frac{2\gamma}{\alpha + \beta + \gamma} \sqrt{\frac{1}{w \times h} \sum_{x=1}^{w/2} \sum_{y=1}^{h/2} |V_i(x, y) - V_k(x, y)|^2}$$

where F_i is the first frame, F_k is the second frame, $F(x, y)$ denotes the $(x, y)^{th}$ pixel in frame F , w is a frame width and h is a frame height, $Y(x, y)$ corresponds to a pixel luminance value, and $U(x, y)$ and $V(x, y)$ corresponds to chromaticity components, and α , β , and γ are weighting coefficients for luminosity, chromaticity-blue and chromaticity-red components correspondingly.

6. The method as defined in Claim 5, wherein $\alpha = \beta = 1$.
7. The method as defined in Claim 1, wherein the first MAD value is calculated using luminance value and excluding chromaticity components.
8. The method as defined in Claim 1, wherein the first criterion is a first threshold and the second criterion is a second threshold.
9. A method of detecting a scene change in a digital video sequence, the method comprising:
 - calculating a second temporal derivative RMS value for a first frame relative to a second frame and the second frame relative to a third frame; and
 - based at least in part on the second derivative value, determining that the second frame is a scene change frame.
10. The method as defined in Claim 9, wherein the determination that the second frame is a scene change frame is further based upon a mean absolute difference value calculated using at least luminosity information for the first and the second frames.
11. The method as defined in Claim 9, wherein the determination that the second frame is a scene change frame is further based upon both an RMS value meeting a first criterion and the second temporal derivative RMS value meeting a second criterion.
12. The method as defined in Claim 9, wherein the second temporal derivative RMS value is greater than or equal to a first threshold.
13. The method as defined in Claim 9, wherein the second frame is designated as a scene change frame when the second temporal derivative RMS value is negative and has a greater absolute value than a first value.
14. The method as defined in Claim 9, further comprising calculating a first RMS value, wherein the first RMS value is color weighted and the second temporal derivative RMS value is based only on temporal components.
15. The method as defined in Claim 9, wherein the second temporal derivative RMS value is equal to $(\text{RMS}(F_{i-1}, F_i) - 2\text{RMS}(F_i, F_{i+1}) + \text{RMS}(F_{i+1}, F_{i+2}))$, where F_{i-1} is the first frame, F_i is the second frame, F_{i+1} is a third frame, and F_{i+2} is a fourth frame.
16. An apparatus for identifying a scene change in a video sequence, the apparatus comprising:

a first instruction stored in processor readable memory, the first instruction configured to calculate a first root mean squared (RMS) value for a first portion of a video sequence relative to a second portion of the video sequence;

a second instruction stored in processor readable memory, the second instruction configured to calculate a second temporal derivative RMS value; and

a third instruction configured to cause the second portion of the video sequence to be intracoded based at least in part on the second derivative RMS value.

17. The apparatus as defined in Claim 9, wherein the third instruction is further configured to cause the second portion of the video sequence to be intracoded based upon a mean absolute difference value calculated using at least luminosity information for first portion and the second portion.

18. The apparatus as defined in Claim 9, wherein the third instruction is further configured to cause the second portion of the video sequence to be intracoded at least partly in response to both the RMS value meeting a first criterion and the second temporal derivative RMS value meeting a second criterion.

19. The apparatus as defined in Claim 9, wherein the third instruction is further configured to store in processor readable memory a flag indicating that the second portion is to be coded as an I-frame.

20. The apparatus as defined in Claim 9, wherein the first portion is a first frame and the second portion is a second frame.

21. The method as defined in Claim 9, wherein the third instruction identifies the first portion as including a scene change when the second derivative value is negative and has a greater absolute value than a first value.

22. The method as defined in Claim 9, wherein the first RMS value is color weighted.

23. The apparatus as defined in Claim 9, wherein the apparatus is an integrated circuit.

24. A method of determining which portions of a video sequence are to be intracoded, the method comprising:

calculating a first root mean squared (RMS) value for a first portion of the video sequence;

calculating a first mean absolute difference (MAD) value for the first portion of the video sequence;

determining if the first RMS value meets a first criterion;

determining if the first MAD value meets a second criterion;

determining if the first MAD value meets a third criterion; and

causing an intracoding operation to be performed at least partly in response to at least two of the first, second and third criteria being met.

25. The method as defined in Claim 24, wherein the third criterion is that the MAD value is a local maximum.

26. The method as defined in Claim 24, wherein the first portion of the video sequence includes a first frame.

27. The method as defined in Claim 24, wherein the first portion of the video sequence includes a first GOV.

28. The method as defined in Claim 24, wherein the first portion of the video sequence includes a first GOP.

29. A scene change detection apparatus, comprising:

an RMS circuit having a first frame information input and an RMS output, the RMS circuit configured to provide at the RMS output a value corresponding to root mean squared differences information between at least two frames based on frame information received on the first frame information input;

a MAD circuit having a second frame information input and a MAD output, the MAD circuit configured to provide at the MAD output a value corresponding to mean absolute differences information between at least two frames based on frame information received on the second frame information input; and

an evaluator circuit coupled to the RMS output and the MAD output, the evaluator circuit configured to detect a scene change frame based at least on the value corresponding to root mean squared differences information and the value corresponding to mean absolute differences information, and to provide a scene change designation.

30. The apparatus as defined in Claim 28, further comprising a second derivative RMS circuit having a third frame information input and a second derivative RMS output, the second derivative RMS circuit configured to provide at the second derivative RMS output a value corresponding second derivative root mean squared differences information based on frame information received on the third frame information input, wherein the second derivative RMS output is coupled to the evaluator circuit.